REMARKS

Status of the Claims

After entry of the instant amendment, claims 2 and 4-9 are pending in the present application. Claims 1 and 3 have been cancelled and claim 2 has been amended without prejudice or disclaimer of the subject matter contained therein. Claims 4-7 have been withdrawn from consideration as being drawn to a non-elected invention. New claims 8 and 9 have been added.

Support for the amendment of claim 2 and new claims 8 and 9 can at least be found at page 7, line 17 to page 9, line 12; the scheme in Synthesis Example 1; and original claims 1 and 3 of the Specification. Thus, no new matter has been added by way of amendment to the claims. Reconsideration of this application, as amended, is respectfully requested.

Sequence Compliance

It is stated in the Office Action that the Specification includes sequence disclosures that are not in compliance with requirements for patent applications containing nucleotide sequences.

Enclosed herewith in full compliance with 37 C.F.R. §§ 1.821-1.825 is a Sequence Listing to be inserted into the Specification as indicated above. The Sequence Listing in no way introduces new matter into the Specification. Also submitted herewith in full compliance with 37 C.F.R. §§ 1.821-1.825 is an electronic CRF copy of the Sequence Listing. The electronic CRF copy of the Sequence Listing, file "2010-03-042114-0116PUS1_ST25.txt" is identical to the paper copy, except that it lacks formatting. The enclosed paper copy and the electronic CRF copy of the Sequence Listing do not include new matter.

The Specification is amended to properly identify each disclosed sequence with a corresponding sequence identification number (SEQ ID NO). No new matter is introduced by these amendments.

Priority under 35 U.S.C. § 119

Applicants thank the Examiner for acknowledging Applicants' claim for foreign priority under 35 U.S.C. § 119, and receipt of copies of the certified copies of the priority documents from the International Bureau.

In the Office Action, it is stated that Applicants cannot rely upon the copies of the foreign priority documents to overcome rejections, because a translation of the documents has not been made of record in the present application. Applicants are co-filing herewith a certified English translation of Japanese Patent Application No. 2004-055086 filed at the Japanese Patent Office on February 27, 2004, to which the present application claims priority.

Rejection Under 35 U.S.C. § 112, second paragraph, Indefiniteness

Claims 1-3 stand rejected under 35 U.S.C. § 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which Applicants regard as the invention. Claims 1 and 3 have been cancelled and their rejection is moot.

In the Office Action, it is asserted that the phrases "azobenzene, spiropyran, stilbene, and derivatives thereof" and "3'-side end" are not sufficiently defined by the Specification or claims. Claim 2 does not recite a "3'-side end," as it is unnecessary in view of the Formulae recited in the claim. Thus, this issue is obviated.

While Applicants respectfully disagree with the assertion that the phrase "derivatives thereof" (as it relates to azobenzene, spiropyran and stilbene) is not sufficiently defined by the Specification or claims, in order to expedite prosecution of the present application, Applicants have amended claim 2 to recite "azobenzene, azobenzene derivatives, spiropyran, and stilbene," and to incorporate the azobenzene derivatives recited in original claim 3 (now cancelled). In view of the discussion above, Applicants respectfully request that the rejection of claim 2 under 35 U.S.C. § 112, second paragraph, be withdrawn.

Rejections Under 35 U.S.C. § 102(a)

Claims 1-3 stand rejected under 35 U.S.C. § 102(a) as being anticipated by Liu et al., "Light-regulated Catalysis by an RNA-cleaving Deoxyribozyme," Journal of Molecular Biology, August 2004, Vol. 341, pp. 887-892 (hereinafter "Liu").

Claims 1-3 stand rejected under 35 U.S.C. § 102(a) as being anticipated by Kuramochi et al., "Light-regulated Catalysis by an RNA-cleaving Deoxyribozyme," CSJ: Japan Chemical Society of Japan Preprints, Vol. 84, No. 2, March 11, 2004, p. 1070 (hereinafter "Kuramochi").

Claims 1 and 3 have been cancelled and their rejection is now moot.

As discussed above, Applicants are co-filing herewith a certified copy of an English translation of Japanese Patent Application No. 2004-055086 filed at the Japanese Patent Office on February 27, 2004, to which the present application claims priority. Thus, Liu and Kuramochi are not available as prior art, and Applicants respectfully request that the rejection of claim 2 as being anticipated by Liu or Kuramochi be withdrawn.

Rejections Under 35 U.S.C. § 102(b) and § 103(a)

Claims 1-3 stand rejected under 35 U.S.C. § 102(b) as being anticipated by or, in the alternative, under 35 U.S.C. § 103(a) as being obvious over Yamazawa et al., Polymer Preprints, Japan, Vol. 50, No. 5 (2001), p. 977 (hereinafter "Yamazawa"). Claims 1 and 3 have been cancelled and their rejection is therefore moot. Applicants respectfully traverse rejection of claim 2 as being anticipated by or, in the alternative, as being obvious over Yamazawa.

An article by the Applicants (Asanuma *et al.*, Chem. Commun. 2006, 5062-5064 (hereinafter "Asanuma")), which was published after the application date, is being submitted with the co-filed IDS for the Examiner's reference and to aid in distinguishing the claimed invention over Yamazawa.

The claimed invention is directed to a DNA enzyme comprising a catalytically active loop domain flanked by substrate binding arm I and II (see Fig. 1 of Asanuma reference submitted with the co-filed IDS). The claimed DNA enzyme is modified by inserting azobenzene, an azobenzene derivative, spiropyran, or stilbene into a site located within the loop domain at the junction with binding arm II, as shown for insertion of t-azobenzene into site "X" in Fig 1 of Azanuma.

Yamazawa is a publication presented by the Applicants at the annual meeting of "The Society of Polymer Science", Japan, and an English translation of Yamazawa is being submitted with the co-filed IDS. Yamazawa discloses a DNA enzyme with an azobenzene group inserted at a location within binding arm I or II. This DNA enzyme showed a poor capability to be

controlled by light irradiation and a lower activity level than that of the native DNA enzyme.

The claimed invention cannot be anticipated by Yamazawa, because Yamazawa does not teach every element of the claimed invention. Specifically, Yamazawa does not teach a DNA enzyme modified by insertion of an azobenzene group, an azobenzene derivative group, a spiropyran group, or a stilbene group as recited in claim 2 (at the junction of the loop domain and binding arm II).

Applicants respectfully traverse the rejection of claim 2 as being obvious over Yamazawa. In contrast to the DNA enzyme disclosed by Yamazawa, which has no practical use, the modified DNA enzyme of the claimed invention shows improved RNA cleavage activity compared to the native enzyme and its activity is controllable by light. These results are summarized in the penultimate paragraph of the Asanuma publication.

At the time the claimed invention was made, it was thought that although the sequence of the substrate-recognition domains (arm I and II) could be changed, the complete loop sequence was required for retaining activity, and therefore could not be altered. This is described in the publication by S. W. Santoro and G. F. Joyce (PNAS, USA, 1997; 94:4262-4266), which was previously submitted with an IDS filed November 27, 2006. The 10-23 DNA enzyme described by Santoro corresponds to the native form of the DNA enzyme disclosed in the present Specification.

Santoro disclosed that although the sequence of the binding domains could be changed to affect specificity for various RNA substrates without loss of catalytic activity, the catalytic loop domain of the 10-23 DNA enzyme was completely intolerant of variation (Santoro page 4265, last paragraph of left column). The present Specification discloses that it is the site in the catalytically active loop at the junction with binding arm II (recited in the Formulae of claim 2), and not binding arm I and II, that is important as an insertion position. This is contrary to the teachings of Santoro.

Furthermore, because an azobenzene group, an azobenzene derivative group, a spiropyran group, or a stilbene group does not occur naturally in DNA enzymes and as these groups are linked to the DNA enzyme by a synthetic skeleton in the claimed invention, a person of ordinary skill in the art would have expected that insertion of such groups into the catalytically active loop would decrease the activity of DNA enzyme based on the teachings of

Santoro.

In view of the discussion above, Applicants submit that it would not have been obvious to one of ordinary skill in the art to alter the azobenzene insertion point taught in Yamazawa by modifying the catalytic loop domain with azobenzene, an azobenzene derivative, spiropyran, or stilbene in order to arrive at the claimed invention, and there would have been no reasonable expectation of such a modification being successful.

One of ordinary skill in the art would not have expected the advantages (high cleavage activity and capability of being controlled by irradiation with UV light) of the claimed DNA enzymes at the time the invention was made. A DNA enzyme disclosed by Yamazawa corresponds to DNA-3A (disclosed in the present Specification as SEQ ID NO: 9), as both DNA enzymes have an azobenzene group bonded at the same position, which, as shown in Table 3, is four bases upstream of the 3' end of the catalytically active loop. DNA-1A, DNA-1B and DNA-1C are DNA enzymes within the scope of the claimed invention, which have an azobenzene group or azobenzene derivative group bonded to the terminal residue at the 3'-end of the catalytically active loop domain. This is shown in Table 1. DNA-1A, DNA-1B and DNA-1C have a higher RNA cleavage activity than native DNA enzyme (see Table 2) and they are capable of being controlled by irradiation by UV light (see Table 4 with regard to DNA-1A and DNA-1B).

The experimental results described in Table 4 (page 24 of the present Specification) show that, in the absence of UV light irradiation, DNA-1A achieved 38.8% cleavage in 1 hour and DNA-1B achieved 39% cleavage in 1 hour, whereas DNA-3A achieved only 18.5% cleavage in 4 hours. Therefore, the results for DNA-3A, which corresponds to the DNA enzyme disclosed by Yamazawa, were significantly worse than the results for DNA enzymes of the claimed invention.

Furthermore, the activity of DNA-3A did not alter significantly in the presence or absence of UV irradiation, with the difference in activity being only 6.2%. This is in contrast to DNA-1A, wherein the difference in activity under the two opposing conditions was found to be 26.4% and DNA-1B, wherein the difference was found to be 17.3%. This indicates that a DNA enzyme corresponding to DNA-3 is less capable of being controlled by irradiation with UV light.

It is submitted that this directly comparable data provides experimental evidence which shows that a DNA enzyme falling within the scope of the claimed invention is technically advantageous in terms of its activity and the ability to control its activity over the DNA enzyme disclosed by Yamazawa.

Allowance of Corresponding European Patent Application

Applicants have been informed by the European Patent Office in a communication dated October 27, 2009, that it intends to grant a European patent in corresponding European Patent Application No. 05710653.6 (European Publication No. EP1724343). A copy of the allowed claims in the corresponding European Application is attached for the Examiner's convenience.

CONCLUSION

All of the stated grounds of rejection have been properly traversed, accommodated, or rendered moot. Applicants therefore respectfully request that the Examiner reconsider all presently outstanding rejections and that they be withdrawn. It is believed that a full and complete response has been made to the outstanding Office Action, and as such, the present application is in condition for allowance.

Should there be any outstanding matters that need to be resolved in the present application, the Examiner is respectfully requested to contact Stephanie A. Wardwell, Ph.D., Registration No. 48,025, at the telephone number of the undersigned below to conduct an interview in an effort to expedite prosecution in connection with the present application.

If necessary, the Director is hereby authorized to charge any fees required during the pendency of the above-identified application or credit any overpayment to Deposit Account No. 02-2448.

Dated: March 4, 2010

Respectfully submitted,

By #49,501

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Attachments: Certified English Translation of Japanese Patent Application No. 2004-055086
Allowed Claims for Corresponding EP Appl. No. 05710653.6
Sequence Listing
Electronic CRF copy of the Sequence Listing, file "2010-03-042114-0116PUS1_ST25.txt"